

Mc Alester Army Ammunition Plant
Mc Alester
Pittsburg County
Oklahoma

HAER No. OK-1

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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HISTORIC AMERICAN ENGINEERING RECORD

McAlester Army Ammunition Plant

OK-1

Location: In Pittsburg County, near McAlester Oklahoma.

Date of Construction: Established in 1942.

Owner: Department of the Army

Significance: McAlester was established as a Naval ammunition depot, which unlike Army depots, were designed to include munitions manufacturing as well as storage. Continually expanded during WW II and thereafter during the Korean and Vietnam Wars, McAlester was transferred to the Army in 1977.

Historical Report
Prepared by: Robert C. Mack and David A. Fey

Prepared for
Transmittal by: Robie S. Lange, HABS/HAER, 1985.

EXECUTIVE SUMMARY

McAlester Army Ammunition Plant is a government-owned, government-operated munitions manufacturing and storage facility located on a 44,962 acre site near McAlester, Oklahoma. The installation is part of the Army's Armament, Munitions and Chemical Command (AMCCOM). One of two ammunition facilities constructed by the Navy in 1942, the plant was enlarged continuously during World War II and further expanded during the Korean and Vietnam Wars. In addition to 1,863 storage structures, the plant currently includes 102 production and 337 residential, administrative, and support structures. Since 1977 the U.S. Army has operated the plant for the production, renovation, demilitarization, and storage of conventional ammunition.

There are no Category I or II properties at McAlester Army Ammunition Plant. Category III properties include the "C-Tree School," a small schoolhouse that predates the plant construction, and typical examples of "barrel vault" and "Corbetta beehive" explosives storage structures. The barrel vaults served as prototypes for construction of storage facilities at other installations; the beehives were a test for this type of construction, which was not repeated at any additional Navy installations.

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PREFACE

This report presents the results of an historic properties survey of the McAlester Army Ammunition Plant (McAlester AAP). Prepared for the United States Army Materiel Development and Readiness Command (DARCOM), the report is intended to assist the Army in bringing this installation into compliance with the National Historic Preservation Act of 1966 and its amendments, and related federal laws and regulations. To this end, the report focuses on the identification, evaluation, documentation, nomination, and preservation of historic properties at the McAlester AAP.

Chapter 1 sets forth the survey's scope and methodology; Chapter 2 presents an architectural, historical, and technological overview of the installation and its properties; and Chapter 3 identifies significant properties by Army category and sets forth preservation recommendations. Illustrations and an annotated bibliography supplement the text.

This report is part of a program initiated through a memorandum of agreement between the National Park Service, Department of the Interior, and the U.S. Department of the Army. The program covers 74 DARCOM installations and has two components: 1) a survey of historic properties (districts, buildings, structures, and objects), and 2) the development of archaeological overviews. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, directed the program for the Army, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) directed the program for the National Park Service. Sally Kress Tompkins was program manager, and Robie S. Lange was

project manager for the historic properties survey. Technical assistance was provided by Donald C. Jackson.

Building Technology Incorporated acted as primary contractor to HABS/HAER for the historic properties survey. William A. Brenner was BTI's principal-in-charge and Dr. Larry D. Lankton was the chief technical consultant. Major subcontractors were the MacDonald and Mack Partnership and Jeffrey A. Hess. The authors of this report were Robert C. Mack and David A. Fey. The authors gratefully acknowledge the help of Major Theodore L. Roberts, director for Administrative Services, McAlester Army Ammunition Plant, and staff members Garold Stevens and Jim Clark.

The complete HABS/HAER documentation for this installation will be included in the HABS/HAER collections at the Library of Congress, Prints and Photographs Division, under the designation HAER No. OK-1.

Chapter 1

INTRODUCTION

SCOPE

This report is based on an historic properties survey conducted in 1983 of all Army-owned properties located within the official boundaries of the McAlester Army Ammunition Plant (McAlester AAP). The survey included the following tasks:

- . Completion of documentary research on the history of the installation and its properties.
- . Completion of a field inventory of all properties at the installation.
- . Preparation of a combined architectural, historical, and technological overview for the installation.
- . Evaluation of historic properties and development of recommendations for preservation of these properties.

Also completed as a part of the historic properties survey of the installation, but not included in this report, are HABS/HAER Inventory cards for 28 individual properties. These cards, which constitute HABS/HAER Documentation Level IV, will be provided to the Department of the Army. Archival copies of the cards, with their accompanying photographic

negatives, will be transmitted to the HABS/HAER collections at the Library of Congress.

The methodology used to complete these tasks is described in the following section of this report.

METHODOLOGY

1. Documentary Research

The McAlester Army Ammunition Plant (AAP) was one of several government-owned, government-operated facilities constructed during 1940-1943 for the manufacture and storage of conventional ammunition. Since the plant was part of a larger manufacturing network, an evaluation of its historical and technological significance requires a general understanding of the wartime ammunition industry. To identify published documentary sources on American ammunition manufacturing during World War II, the Korean War, and the Vietnam War, research was conducted in standard bibliographies of military history, engineering, and the applied sciences. Unpublished sources were identified by researching the historical and technical archives of the U.S. Army Armament, Munitions and Chemical Command (AMCCOM) at Rock Island Arsenal.¹

In addition to such industry-wide research, a concerted effort was made to locate published and unpublished sources dealing specifically with the history and technology of the McAlester AAP. This site-

specific research was conducted primarily at the AMCCOM Historical Office at Rock Island Arsenal, the Naval Facilities Engineering Command, the Oklahoma State Historic Preservation Office, the McAlester Public Library, and the McAlester AAP, where the facilities Engineer and Real Property Office were particularly helpful. The State Historic Preservation Office provided an unpublished history of the site selection process and several newspaper articles.

On the basis of this literature search, a number of valuable sources were identified. These included several published studies on the construction and operation of ammunition plants and storage facilities, and World-War-II vintage construction photographs and newspaper clippings.

Army records used for the field inventory included current Real Property Inventory (RPI) printouts that listed all officially recorded buildings and structures by facility classification and date of construction; the installation's property record cards; base maps and photographs supplied by installation personnel; and installation master planning, archaeological, environmental assessment, and related reports and documents. A complete listing of this documentary material may be found in the bibliography.

2. Field Inventory

The field inventory was conducted by Robert Mack and Stuart MacDonald in February, 1983. Administrative assistance was provided by Major

Theodore L. Roberts, Garold Stevens, and Jim Clark. Eugene Arpelar, Harold Gray, and Fred Mass served as escorts and guides.

Field inventory procedures were based on the HABS/HAER Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures.² All areas and properties were visually surveyed.

Building locations and approximate dates of construction were noted from the installation's property records and field-verified. Interior surveys were made of the major facilities to permit adequate evaluation of architectural features, building technology, and production equipment.

Field inventory forms were prepared for, and black and white 35 mm photographs taken of all buildings and structures through 1945 except basic utilitarian structures of no architectural, historical, or technological interest. When groups of similar ("prototypical") buildings were found, one field form was normally prepared to represent all buildings of that type. Field inventory forms were also completed for representative post-1945 buildings and structures.³ Information collected on the field forms was later evaluated, condensed, and transferred to HABS/HAER Inventory cards.

3. Historical Overview

A combined architectural, historical, and technological overview was prepared from information developed from the documentary research and the field inventory. It was written in two parts: 1) an introductory

description of the installation, and 2) a history of the installation by periods of development, beginning with pre-military land uses. Maps and photographs were selected to supplement the text as appropriate.

The objectives of the overview were to 1) establish the periods of major construction at the installation, 2) identify important events and individuals associated with specific historic properties, 3) describe patterns and locations of historic property types, and 4) analyze specific building and industrial technologies employed at the installation.

4. Property Evaluation and Preservation Measures

Based on information developed in the historical overviews, properties were first evaluated for historical significance in accordance with the eligibility criteria for nomination to the National Register of Historic Places. These criteria require that eligible properties possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that they meet one or more of the following:⁴

- A. Are associated with events that have made a significant contribution to the broad patterns of our history.
- B. Are associated with the lives of persons significant in the nation's past.

- C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction.
- D. Have yielded, or may be likely to yield, information important in pre-history or history.

Properties thus evaluated were further assessed for placement in one of five Army historic property categories as described in Army Regulation 420-40:⁵

- Category I Properties of major importance
- Category II Properties of importance
- Category III Properties of minor importance
- Category IV Properties of little or no importance
- Category V Properties detrimental to the significance of adjacent historic properties.

Based on an extensive review of the architectural, historical, and technological resources identified on DARCOM installations nationwide, four criteria were developed to help determine the appropriate categorization level for each Army property. These criteria were used to assess the importance not only of properties of traditional historical interest, but also of the vast number of standardized or

prototypical buildings, structures and production processes that were built and put into service during World War II, as well as of properties associated with many post-war technological achievements. The four criteria were often used in combination and are as follows:

- 1) Degree of importance as a work of architectural, engineering, or industrial design. This criterion took into account the qualitative factors by which design is normally judged: artistic merit, workmanship, appropriate use of materials, and functionality.
- 2) Degree of rarity as a remaining example of a once widely used architectural, engineering, or industrial design or process. This criterion was applied primarily to the many standardized or prototypical DARCOM buildings, structures, or industrial processes. The more widespread or influential the design or process, the greater the importance of the remaining examples of the design or process was considered to be. This criterion was also used for non-military structures such as farmhouses and other once prevalent building types.
- 3) Degree of integrity or completeness. This criterion compared the current condition, appearance, and function of a building, structure, architectural assemblage, or industrial process to its original or most historically important condition, appearance, and function. Those properties that

were highly intact were generally considered of greater importance than those that were not.

- 4) Degree of association with an important person, program, or event. This criterion was used to examine the relationship of a property to a famous personage, wartime project, or similar factor that lent the property special importance.

The majority of DARCOM properties were built just prior to or during World War II, and special attention was given to their evaluation. Those that still remain do not often possess individual importance, but collectively they represent the remnants of a vast construction undertaking whose architectural, historical, and technological importance needed to be assessed before their numbers diminished further. This assessment centered on an extensive review of the military construction of the 1940-1945 period, and its contribution to the history of World War II and the post-war Army landscape.

Because technology has advanced so rapidly since the war, post-World War II properties were also given attention. These properties were evaluated in terms of the nation's more recent accomplishments in weaponry, rocketry, electronics, and related technological and scientific endeavors. Thus the traditional definition of "historic" as a property 50 or more years old was not germane in the assessment of either World War II or post-war DARCOM buildings and structures; rather, the historic importance of all properties was evaluated as completely as possible regardless of age.

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approximately ten years after which all categorizations should be
reviewed and updated.

Following this categorization procedure, Category I, II, and III
historic properties were analyzed in terms of:

- Current structural condition and state of repair. This information was taken from the field inventory forms and photographs, and was often supplemented by rechecking with facilities engineering personnel.
- The nature of possible future adverse impacts to the property. This information was gathered from the installation's master planning documents and rechecked with facilities engineering personnel.

Based on the above considerations, the general preservation recommendations presented in Chapter 3 for Category I, II, and III historic properties were developed. Special preservation recommendations were created for individual properties as circumstances required.

5. Report Review

Prior to being completed in final form, this report was subjected to

an in-house review by Building Technology Incorporated. It was then sent in draft to the subject installation for comment and clearance and, with its associated historical materials, to HABS/HAER staff for technical review. When the installation cleared the report, additional draft copies were sent to DARCOM, the appropriate State Historic Preservation Officer, and, when requested, to the archaeological contractor performing parallel work at the installation. The report was revised based on all comments collected, then published in final form.

NOTES

1. The following bibliographies of published sources were consulted: Industrial Arts Index, 1938-1957; Applied Science and Technology Index, 1958-1980; Engineering Index, 1938-1983; Robin Higham, ed., A Guide to the Sources of United States Military History (Hamden, Conn.: Archon Books, 1975); John E. Jessup and Robert W. Coakley, A Guide to the Study and Use of Military History (Washington, D.C.: U.S. Government Printing Office, 1979); "Military Installations," Public Works History in the United States, eds., Suellen M. Hoy and Michael C. Robinson (Nashville: American Association for State and Local History, 1982), pp. 380-400. AMCCOM (formerly ARRCOM, or U.S. Army Materiel Readiness Command) is the military agency responsible for supervising the operation of government-owned munitions plants; its headquarters are located at Rock Island Arsenal, Rock Island, Illinois. Although there is no comprehensive index to AMCCOM archival holdings, the agency's microfiche collection of unpublished reports is itemized in ARRCOM, Catalog of Common Sources, Fiscal Year 1983, 2 vols. (no pl.: Historical Office, ARRCOM, Rock Island Arsenal, n.d.).
2. Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Guidelines for Inventories of Historic Buildings and Engineering and Industrial Structures (unpublished draft, 1982).
3. Representative post-World War II buildings and structures were defined as properties that were: (a) "representative" by virtue of construction type, architectural type, function, or a combination of these, (b) of obvious Category I, II, or III historic importance, or (c) prominent on the installation by virtue of size, location, or other distinctive feature.

4. National Park Service, How to Complete National Register Forms
(Washington, D.C.: U.S. Government Printing Office, January 1977).
5. Army Regulation 420-40, Historic Preservation (Headquarters, U.S.
Army: Washington, D.C., 15 April 1984).

Chapter 2

HISTORICAL OVERVIEW

BACKGROUND

McAlester Army Ammunition Plant is a government-owned, government-operated (GO-GO) munitions manufacturing and storage facility located near McAlester, Oklahoma (Figure 1). The plant currently has over 2,200 structures spread over nearly 45,000 acres of rolling wooded terrain (Figure 2).

Originally designated the McAlester Naval Ammunition Depot*, construction of this facility began in August 1942, and the original construction contract was substantially complete by the end of 1943. The installation was expanded constantly throughout World War II, and actual first phase construction was not completed until 1946. One thousand seven hundred nineteen buildings were constructed during this period: 1,274 munition storage magazines, 152 inert storage buildings, 199 permanent administrative and support buildings (Figure 2), and 94 temporary support facilities. A second major building period during the Korean War resulted in approximately 300 additional magazines, 40 inert storage buildings, and 16 administrative and support buildings. Twenty-one family housing units and 38 support facilities were added during the Vietnam War. At present, McAlester AAP includes 102 manufacturing buildings, 1,863 storage buildings

* This designation was retained until 1977. In the interest of brevity and clarity, the current designation of McAlester Army Ammunition Plant (AAP) will be used throughout this report.

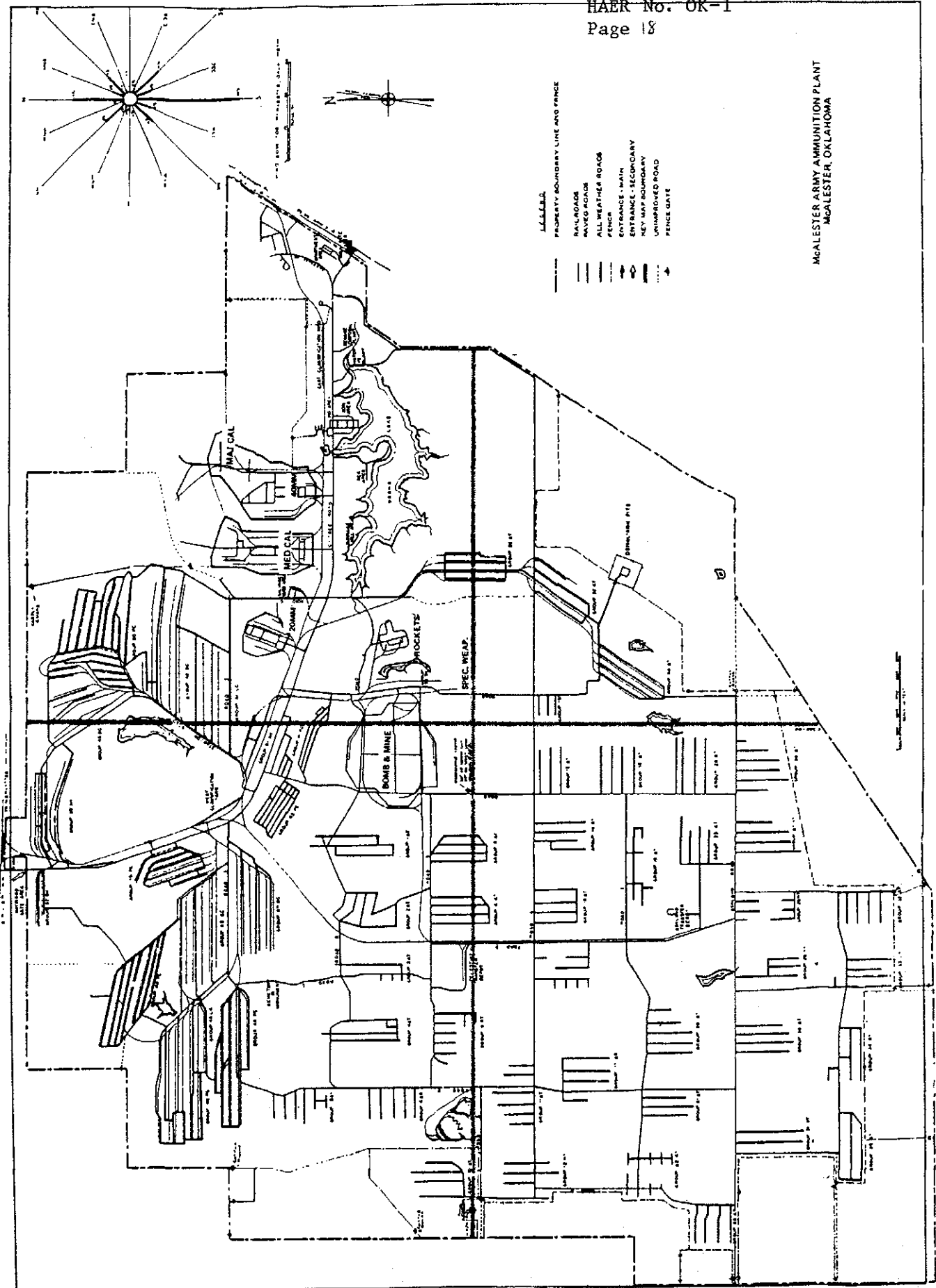


Figure 1: McAlester Army Ammunition Plant. Site Plan. (Source: Government Files, McAlester AAP.)

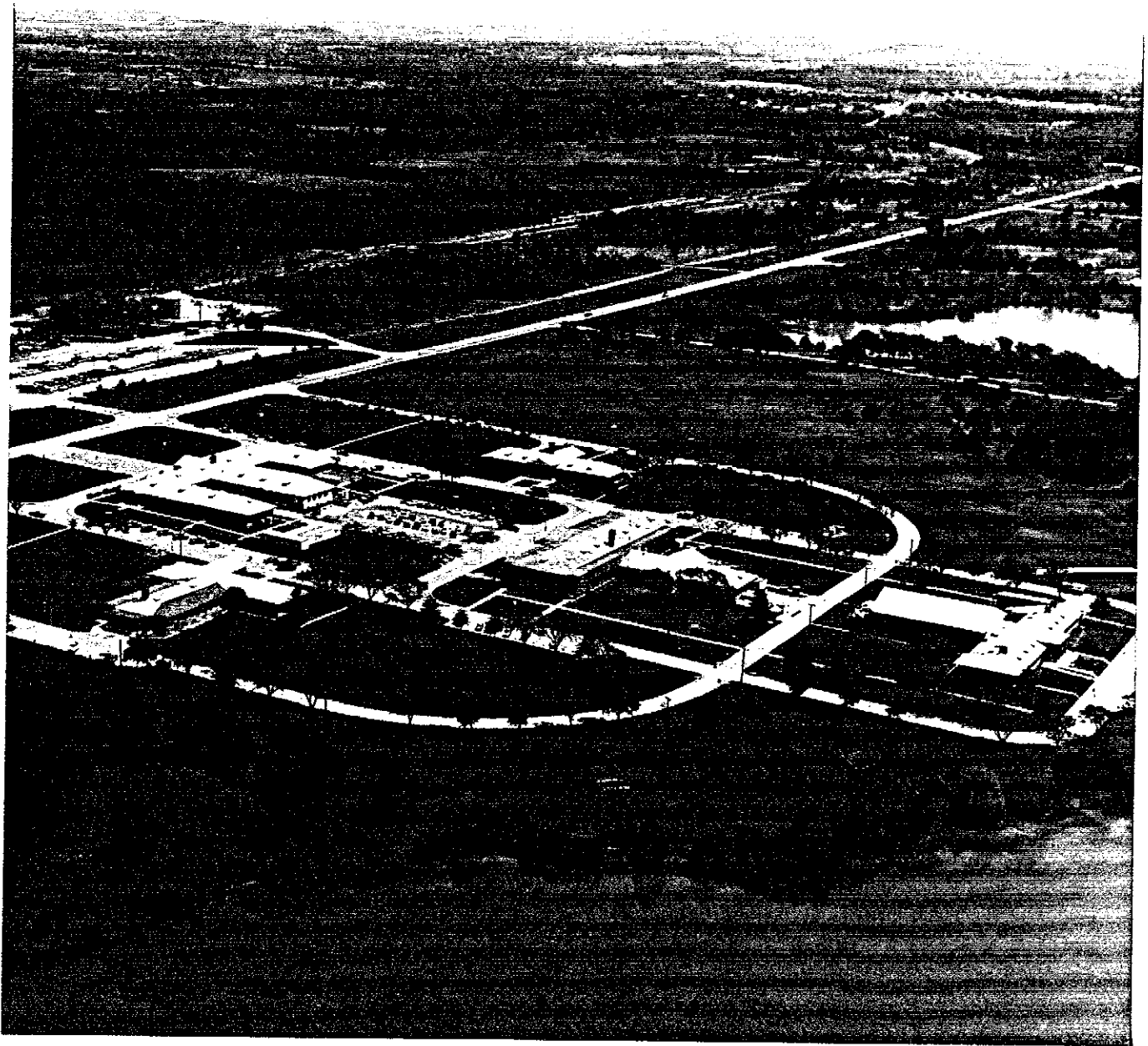


Figure 2: Administrative compound, McAlester AAP. (Source: Government Files, McAlester AAP.)

(both magazines and inert storage), 29 administrative and industrial support buildings, 131 housing and community support buildings, and 77 other miscellaneous structures. The entire facility was transferred to the Army in 1977.

Naval ammunition depots, unlike those of the Army, were designed to include munitions manufacturing as well as storage. McAlester AAP, as a former naval depot, thus has a number of manufacturing functions in addition to its major storage capability. Included in its current manufacturing capabilities are projectile and cartridge loading ranging from 20-mm to major caliber, rocket motor loading, bomb and mine loading, small arms relinking, and the demilitarization of obsolete ammunition.

SITE SELECTION AND PRE-MILITARY LAND USE

The citizens of McAlester had been seeking the construction of federal facilities since the late 1930s in an effort to counteract lagging coal and agricultural sales. They had no success until the spring of 1942 when, following declaration of war, Oklahoma Senator Elmer Thomas informed the community that the Navy would be building new inland munitions depots. The Navy's requirements included 30,000 acres of level land, access to two railroads, good highway connections, and reasonable amounts of electric power. In addition, defense plants were to be located near areas with high unemployment and ready labor pools. Following much political maneuvering, McAlester was selected for one of two major new naval depots.

Selection of the site was announced in early June 1942. The architect/engineers selected included Shaw, Ness & Murphy of Chicago; Charles Deleuw of Chicago; and George M. Brown of McAlester. Construction of the plant by Brown, Root & Bellows of Houston, Texas, began in August.¹

Prior to World War II the McAlester AAP site was used almost exclusively for agricultural purposes, primarily grazing.² The "C-Tree School," a small stone schoolhouse (Building 90) constructed in 1934, is the only existing structure that pre-dates the establishment of McAlester AAP (Figure 3). It is presently used as the office of the Building and Grounds Division of the Facilities Engineering Directorate. Although the interior has been altered, the exterior of the building remains intact and serves as a significant reminder of the history of the site.

The Navy planned the twin depots of McAlester and Hastings, Nebraska, as supplements to existing inland facilities at Hawthorne, Nevada, and Crane, Indiana. The new installations were to contain munitions manufacturing facilities as well as storage facilities.³

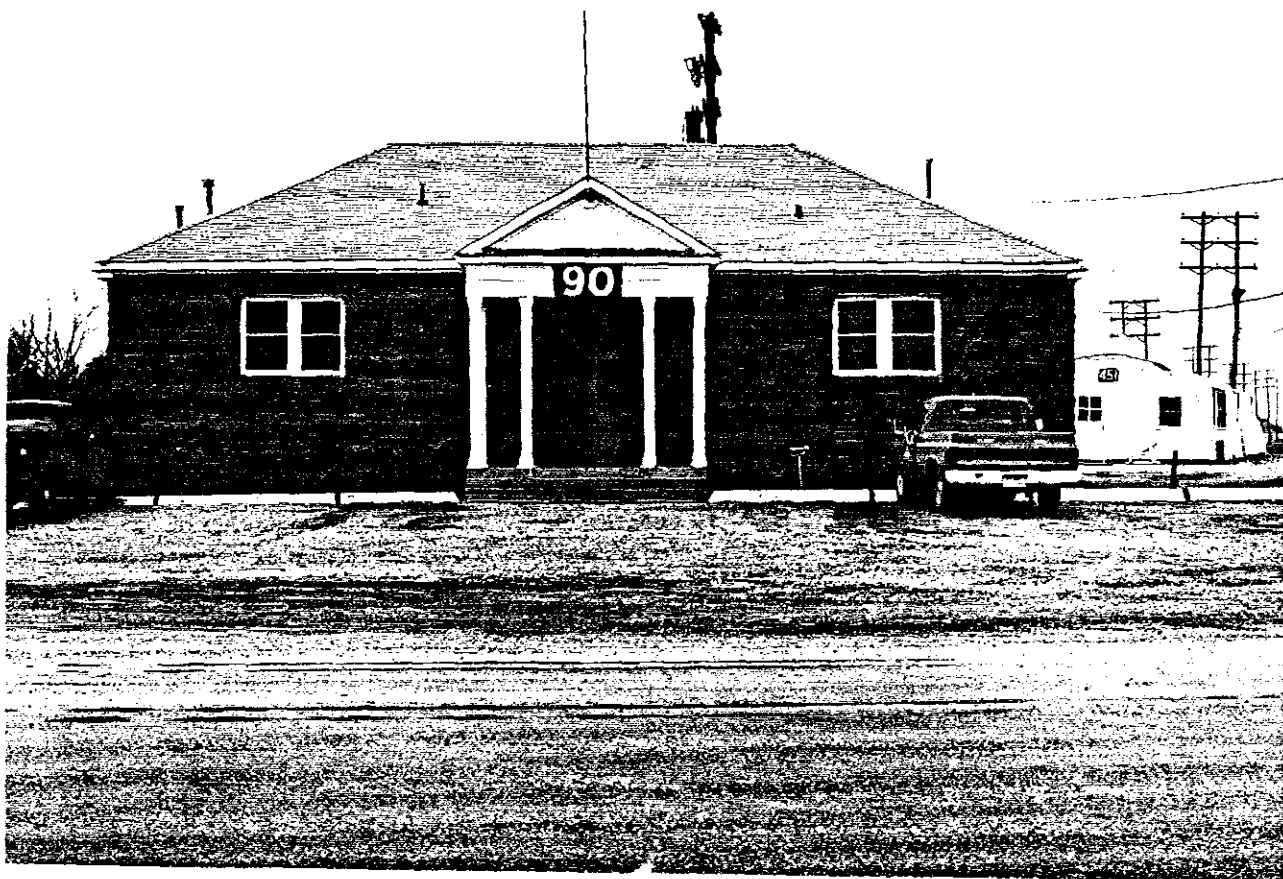


Figure 3: C-Tree School, McAlester AAP. (Source: Field inventory photograph.)

WORLD WAR II CONSTRUCTION

Construction of McAlester Naval Ammunition Depot began on August 15, 1942. Original plans called for 707 storage magazines*, 70 inert storage buildings, two major-caliber loading plants, two medium-caliber loading plants, and two bomb-and-mine filling plants. Within four months, plans were expanded to include 20-mm and 40-mm loading lines. Before the new buildings were completed, plans were again increased to include 333 additional magazines and 30 more inert storage buildings.

Expansion of the depot continued uninterrupted throughout World War II. In November 1943, construction of two rocket-motor loading plants was authorized, and in May 1945, 127 additional magazines and 52 additional inert storage buildings were begun.⁴

Buildings at McAlester AAP were grouped by function. Ammunition production areas were placed near the center of the installation, with inert storage areas adjacent to them. Explosives storage areas and additional inert storage areas surrounded the production center. All production and storage areas were separated by distances sufficient to preclude sympathetic

* Many of the storage magazines at McAlester AAP are "triples." These include both beehive and barrel vault forms. Some of the literature treats each of the three triple sections as a separate building, while other articles treat each group of three as a single building. The latter practice is used in the current real property numbering system and will be followed in this report. Where necessary, quantities of magazines given in the literature have been adjusted to follow this practice.

explosions and/or structural damage at any area in the event of an explosion at an adjacent area.⁵ Separation distances were calculated using standard spacing formulas equating distances in feet to quantities of explosives in pounds.

Although construction cost was a concern, the high quality of building construction makes it clear that the Navy intended McAlester AAP to be a permanent installation: most buildings were built with concrete structural systems and masonry exteriors.⁶

Construction of the depot was not without difficulties. Wet and unstable soil required that much of the overburden be removed before foundations could be poured. A shortage of unskilled labor -- and, more importantly, a shortage of qualified masons to take advantage of locally available materials -- slowed progress. The shortage was so severe, in fact, that many of the inert storage buildings were constructed of poured concrete rather than masonry, as first planned. Such problems delayed the construction schedule by three months. Nevertheless, the depot was sufficiently complete to permit its commissioning in May 1943.⁷

Production Facilities: Individual production areas reflected industrial function and concern for safety. Typically, they featured linear arrangements of widely separated buildings interconnected by enclosed "ramps" that housed conveying and utility systems. The bomb-and-mine filling areas, for example, extended approximately 1,200 feet from the preparation building to the cooling shed. The major buildings along a typical bomb-and-mine line include the Bomb Preparation Building (Building

175), the Explosives Box Opening Building (Building 179), the Bomb-and-Mine Filling Building (Building 177) also known as the Melt-Pour Building, and the Cooling Shed (Building 180), all joined by ramps up to 800 feet long. Additional support facilities, such as the Lunch-and-Locker Building (Building 176) and various receiving, shipping, and storage facilities complete the group (Figure 4).

The five other production facilities (20-mm cartridges, 40-mm cartridges, medium-caliber ammunition, major-caliber ammunition, and rocket motor loading) employed similar concepts in their layouts (Figure 5).

Inert Storage Facilities: When construction of McAlester AAP began, 70 inert storage buildings of approximately 10,000 square feet each were planned, but this number was soon increased to 100. The shortage of masons led to the use of poured concrete for the structures, instead of clay tile.⁸ The earliest buildings were grouped at manufacturing facilities (Groups 54SH, 55SH, and 56SH) and at a centralized location (Group 51SH).

Explosives Storage Facilities: Because the primary purpose of McAlester AAP was for inland storage of explosive naval ordnance, the vast majority of buildings constructed during the World War II period were explosives storage facilities. Four basic types of magazines were constructed: (1) triple Corbetta beehives, (2) triple barrel vaults, (3) rectangular boxes, and (4) single barrel vaults. They are described as follows:

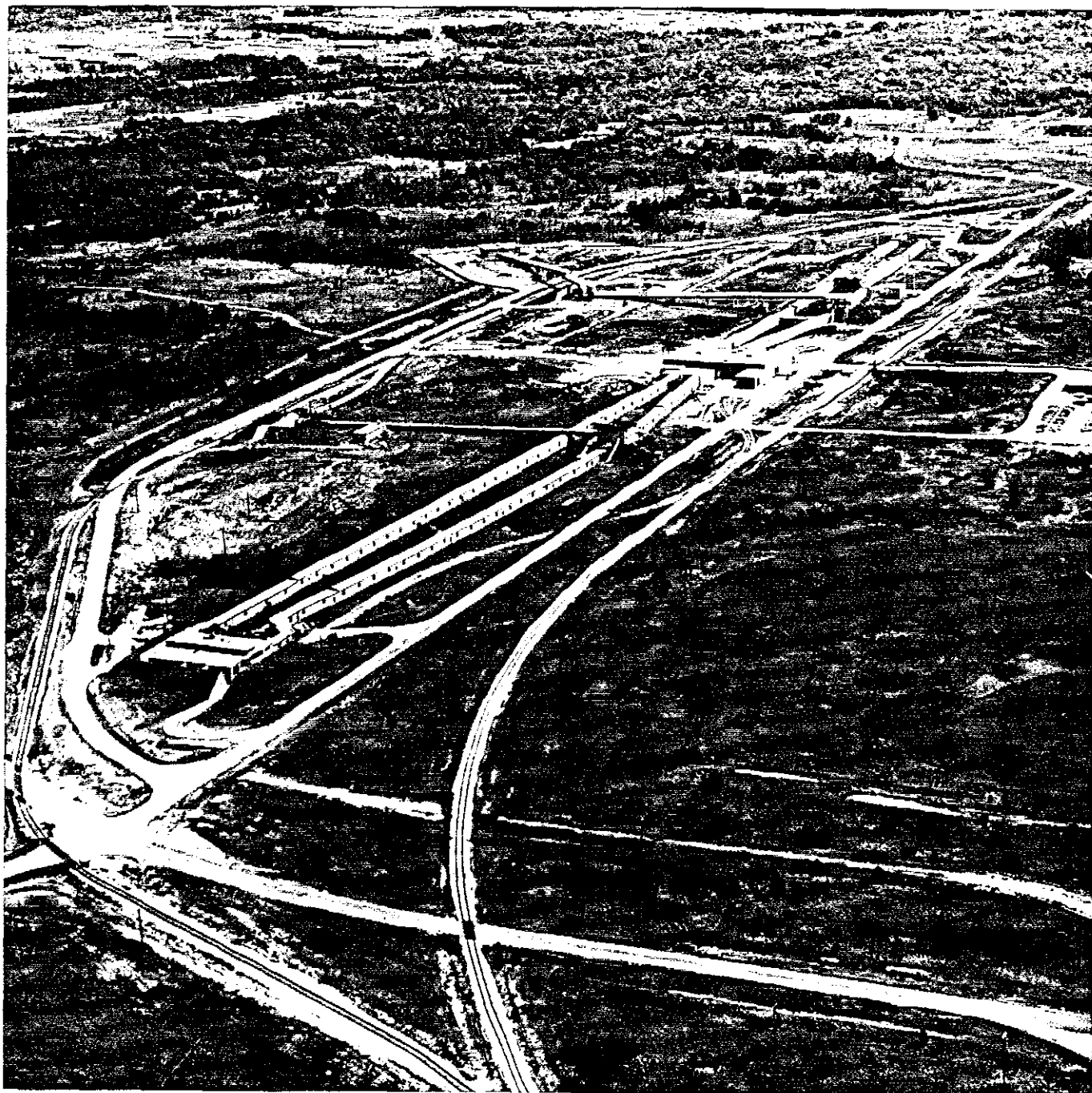


Figure 4 Bomb and mine production area, McAlester AAP.
(Source: Government Files, McAlester AAP.)

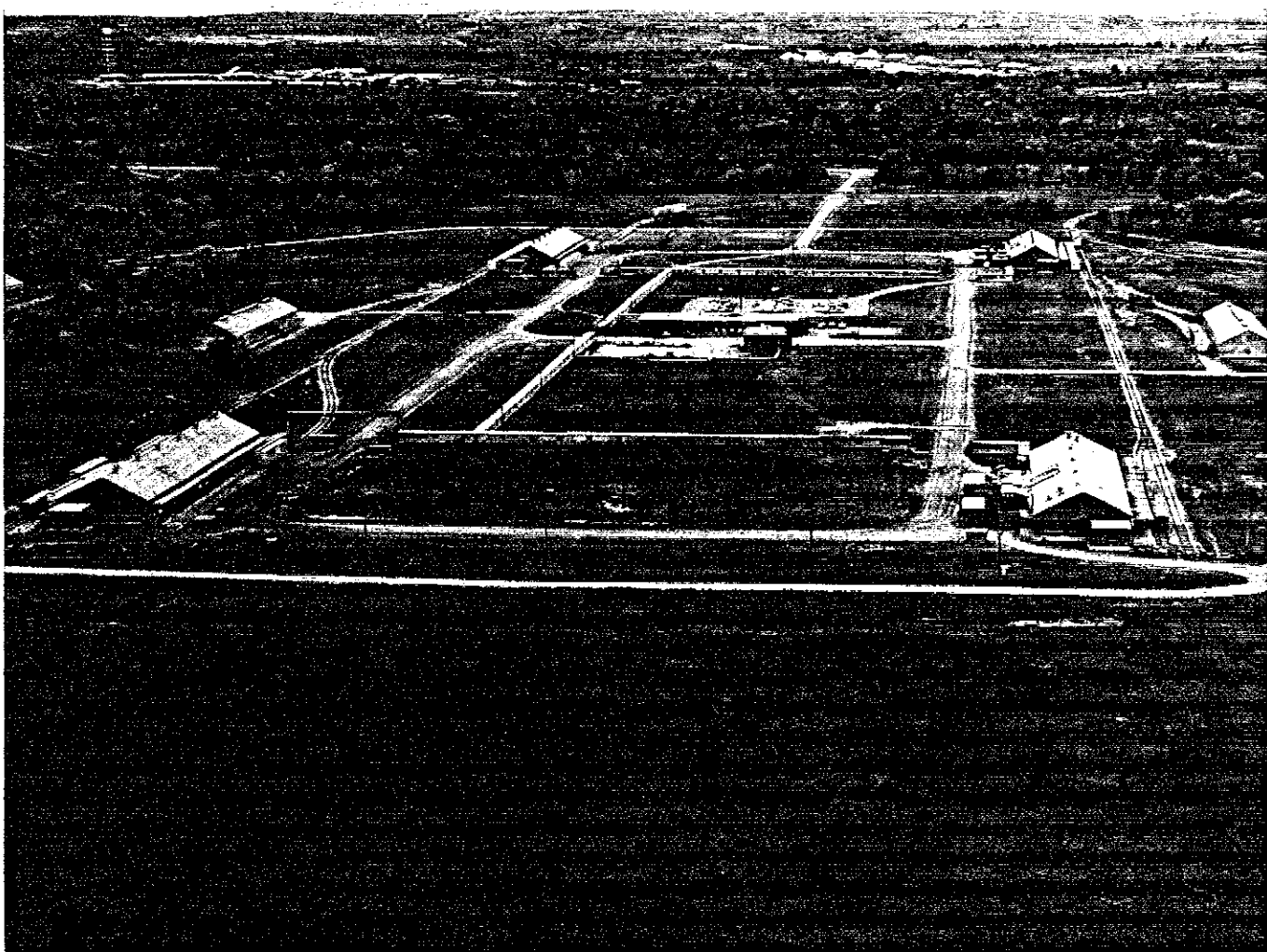


Figure 5: 40mm production area, McAlester AAP. (Source: Government Files, McAlester AAP.)

- (1) Triple-Corbetta-beehive magazines are 52'-diameter, spheroid domes constructed of poured concrete approximately six inches thick. The dome rises to a central point approximately 16'2" above the floor. The cubic footage of storage space thus created is nearly equal to that of standard 25' by 80' barrel vault magazines. The beehive shape, however, required only half the steel, one-third the copper, and two thirds the concrete of the more traditional forms. Construction costs, however, were comparable to the barrel vault structures due to more extensive use of labor. The unique beehive design was developed by the Corbetta Construction Company at the suggestion of Col. B. F. Vandervort of the Army Corps of Engineers. The first prototypes were completed in January 1942, and construction began in May 1942. The design was later refined to further reduce material requirements and to simplify construction procedures.⁹

Construction of the triple Corbetta beehives (Groups 42DC-45DC), begun in late 1942, was completed by the end of 1943.¹⁰ The beehives were built in 220 groups of three each with a common rail loading dock (Figure 6). The entrances to the two outer magazines were spaced so that they would align with the doors to the rail cars. Construction began by placing a simple concrete hub at the center of the magazine, with the remainder of the base laid out around it. The same hub was used as the base for a pipe mast around which the forming and reinforcing for the dome could be placed. The dome was made totally independent of the slab, with circumferential stresses resisted by

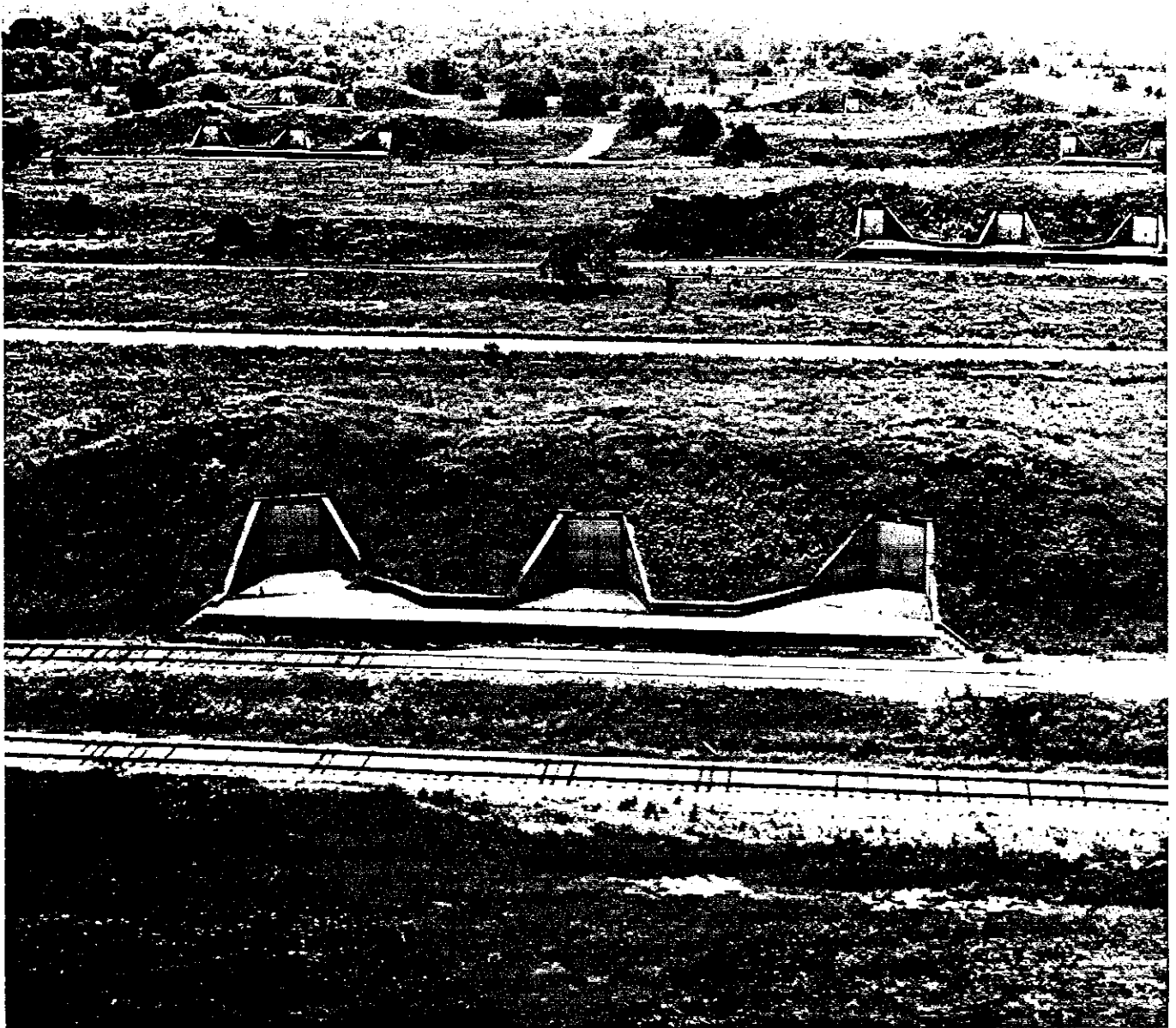


Figure 6: Triple-Corbetta-Beehive magazine, McAlester AAP.
(Source: Government Files, McAlester AAP.)

tension reinforcing. Concrete placement was accomplished by using a standard concrete paver rotated around the central mast.¹¹

- (2) The triple-barrel-vault magazines are approximately 80' long by 26'6" wide with a maximum height of 12' (Figure 7). The concrete walls taper from 12" at the base to 6" at the peak. The triple-barrel-vault magazines built during World War II incorporated a number of design modifications from the Navy's earlier "Standard Underground Storage Magazine." Foundations for the McAlester magazines were simply thickened areas of the floor slab, thus eliminating the need for massive spread footings, deep foundation walls, and tie beams. In addition, reinforcing steel was changed from bars to mesh. These design modifications resulted in a reduction of nearly two-thirds of the reinforcing steel required for each structure. The use of mesh also vastly reduced the work required to provide electrical grounding for the steel, since the wires already were welded together, forming sound connections.¹²

Erection of the McAlester AAP triple-barrel-vaulted magazines (Groups 41LC, 46LC) began in late 1942 and was completed by the end of 1943.¹³ The structures are in 120 groups of three each with a common rail loading dock. Magazines are approximately 13 feet apart at the spring-line of the vaults, making them separate structures except for a common front wall. Although foundation and reinforcing designs were simplified, the actual construction was accomplished using techniques and steel forms developed in 1940 and 1941 at other installations.¹⁴

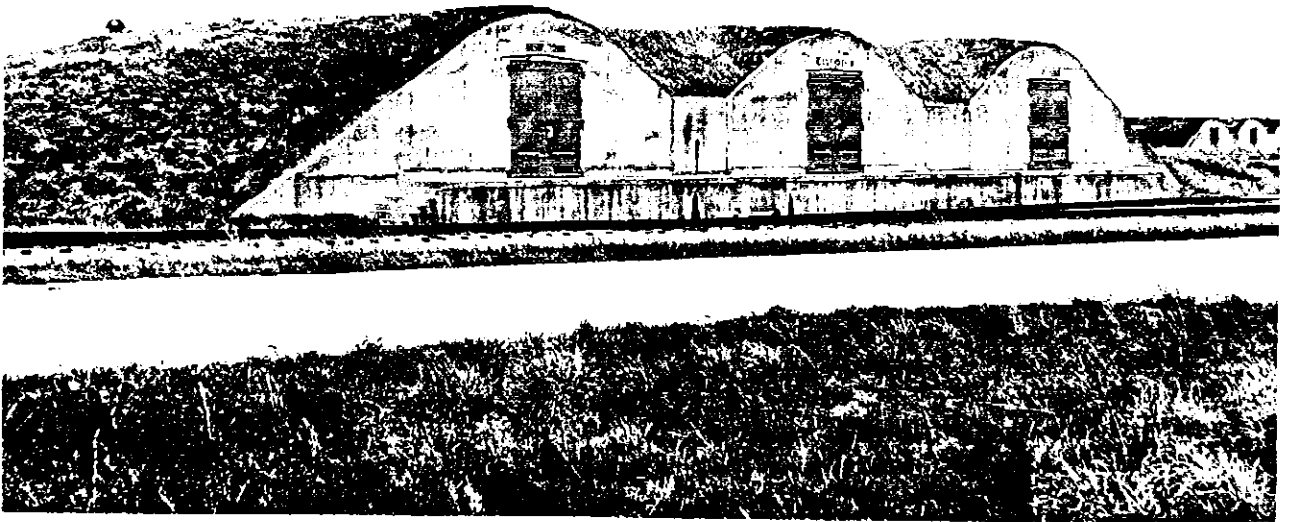


Figure 7: Triple-barrel-vault magazine, McAlester AAP.
(Source: Field inventory photograph.)

- (3) The rectangular-box magazines were erected late in World War II for smokeless powder and the storage of completed projectiles (Figure 8). These magazines (Groups 49PC, and 50PC) are concrete boxes nominally 100' wide, 50' deep, and 14' high. The interior is a single open space with roof support columns on approximately 17' centers. The expansive front wall has two sets of double doors and four pairs of glass-block windows. The other three sides and the top have earth fill.¹⁵ One hundred thirty-four of these magazines were completed in the months following the close of World War II.¹⁶
- (4) The single-barrel-vault magazines were built in three forms. The most common is the nominal 25' by 80' (actually, 26'6" by 80') barrel-vaulted magazine with a reinforced berm located across the entry drive from the door (Figure 9). There are 700 of these high explosives magazines (Groups 1AT-35AT), all of which were completed in 1943. Also completed in 1943 were 101 barrel-vaulted fuse and detonator magazines (portions of Groups 61FC, 62FC), which were nominally 25' by 20' and had no opposing berm. The last group of barrel-vaulted magazines (Group 71BT) was not completed until 1946. These are twelve black-powder magazines, nominally 25' by 40', that have a reinforced berm opposing the entry. Construction of the three types of single-barrel-vault magazines was identical to that of the triple vaults.

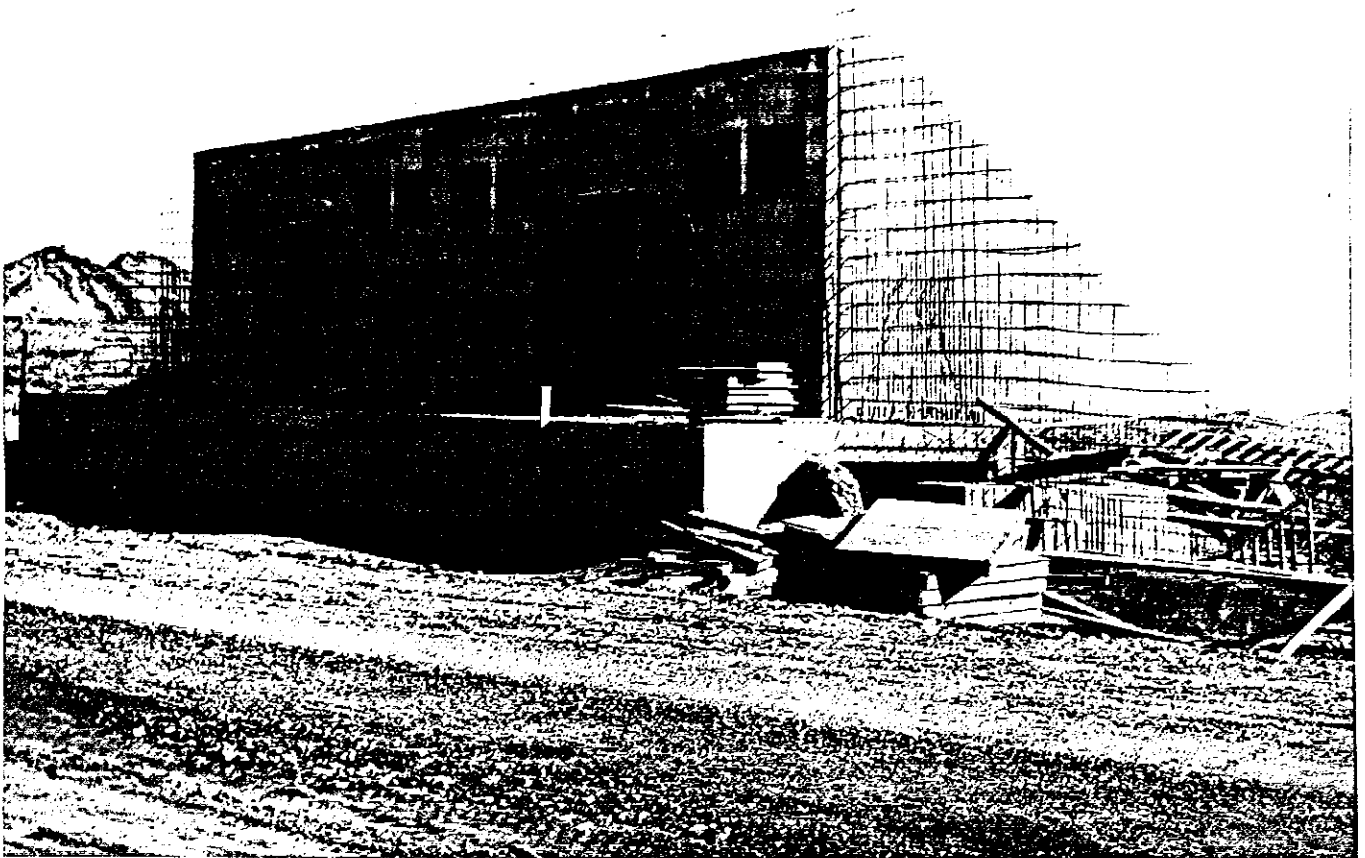


Figure 8: Rectangular magazine under construction, McAlester AAP. (Source: Government Files, McAlester AAP.)

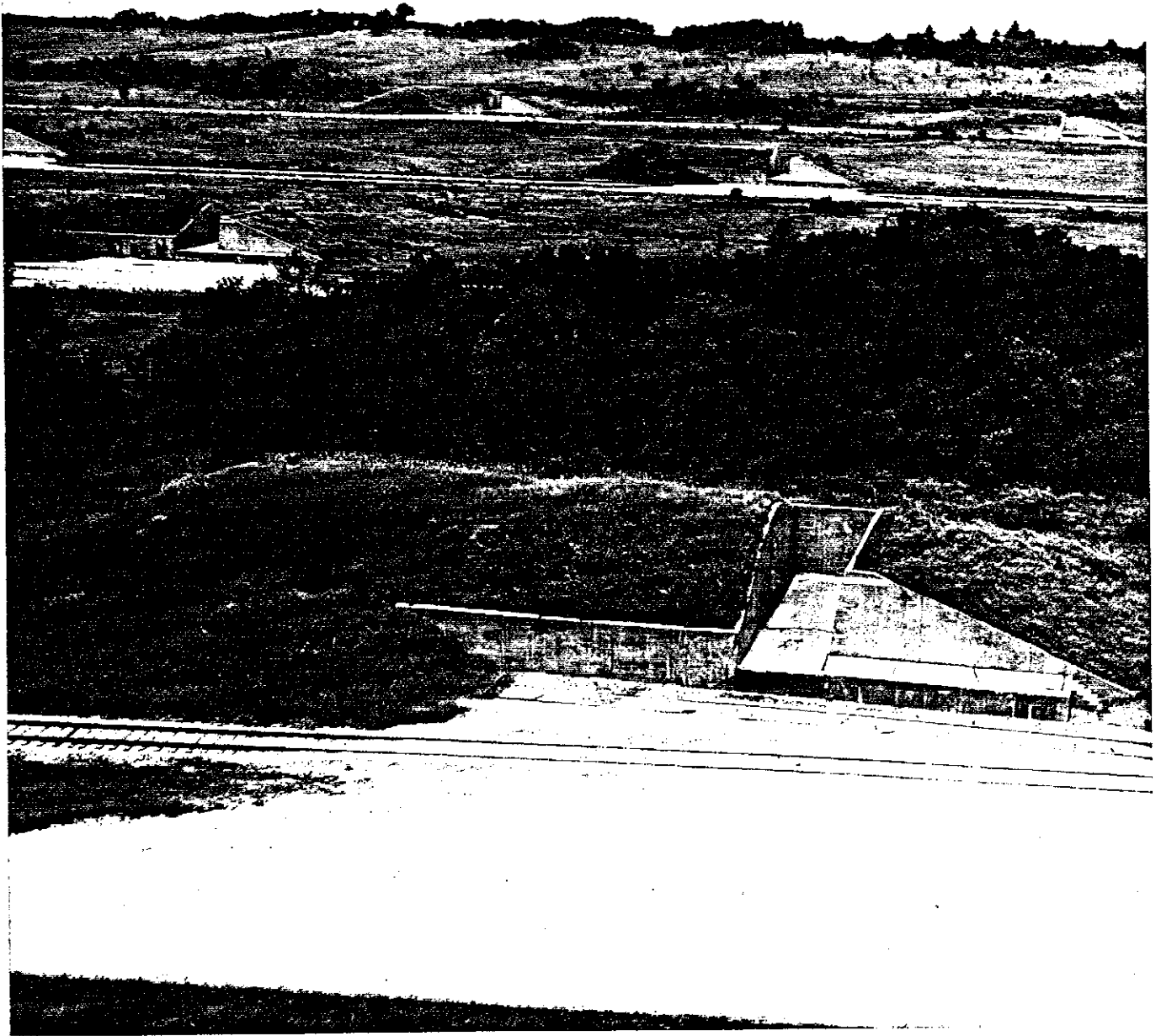


Figure 9: High explosive magazine, McAlester AAP. (Source: Government Files, McAlester AAP.)

Technology

Manufacturing began on September 4, 1942, and increased steadily until August 1945. During this period the plant demonstrated considerable flexibility, producing over 25 separate types of ammunition, including filled projectiles and bag charges from 5" to 14", cartridges and cases from 3" to 6", 20-mm and 40-mm ammunition, three types of rockets, and a variety of mines.

Most of the load-assemble-and-pack (LAP) processes at McAlester AAP consisted of the final assembly of component parts and materials into completed ammunition. These processes were common to most LAP facilities, both Army and Navy, and have been described in the following way:

The explosives, shell or bomb casings, cartridge cases, fuzes, primers, boosters, and detonators are received from outside manufacturers. They are then inspected and stored. The loading and assembling of these materials is carried on as an assembly-line process. Various . . . "load lines" are maintained for the processing of each particular type of ammunition. Thus a plant may have, in addition to one or more shell- or bomb-load lines, separate lines for loading such component parts as detonators, fuzes, primers, and boosters

The main loading operation for shells and bombs is generally performed by either the melt-load or the press-load process. On the load line, the shell or bomb casings are cleaned, inspected, and painted. Large-caliber shells and bombs are usually filled by the melt-load process, the major operations of which consist in screening, melting, and pouring the main explosive or bursting charge into the shell or bomb cavity [Figure 10]. The most commonly used bursting charge is TNT, which is readily melted either alone or with ammonium nitrate. After the TNT has hardened, the booster and fuze are inserted. Some large-caliber shells are shipped to combat zones unfuzed, and the fuze is assembled in the field prior to firing the shell. In the case of fixed and semi-fixed rounds of ammunition, the projectile is assembled to the cartridge case, which contains the propellant charge and artillery primer. The final operations involve labeling and packing

or crating for storage or shipment. Inspection is carried on continuously at each stage of the operation.

The operations performed on the lines loading shells by the press-load process differ somewhat from those where the melt-loading process is used. The main explosive charge is loaded into the projectile in a dry, rather than molten state, and consolidated into the shell by means of a hydraulic press. Press loading is most generally applied to small-caliber shells, such as those used in 20-mm and 40-mm cannon [Figure 11]. . . .

Bag loading -- The loading of propellant charges into ammunition bags for semifixed and separate-loading ammunition is a far more simple operation and requires equipment quite different from that used in bomb- and shell-loading plants. The major operations involved in the bag-loading plants are the cutting and sewing of cloth bags of various sizes and the loading of these bags with specific amounts of smokeless powder for propellant charges or black powder for igniter charges.

In the bag-making department the cloth is spread and cut into specified sizes and shapes, depending upon the type of charge which is to be loaded. After identification of the charge has been printed on these pieces of cloth, they are sent to the sewing room to be made into bags by seaming on power sewing machines. An opening is left in the bag for pouring in the powder charge.

The bag-loading lines are made up of buildings for the actual loading of the gunpowder and a number of widely spaced and barricaded storage magazines. The bag-loading buildings are divided into small rooms with thick concrete walls between them for safety of the operators. In these small rooms, each having only a limited number of operators, the explosive powder is carefully weighed and poured into the bags which have been transferred from the bag-making department. The bag is then closed on a sewing machine and is ready for final inspection and packing. For certain types of ammunition, several bags are tied together before packing, to form a charge made up of several increments.

Between 1942 and 1945, ammunition lines and machinery were continually modified in response to the changing materiel needs of the war effort. The 20-mm manufacturing area, for example, was changed from production of new cartridges to reworking of existing cartridges. Similarly the bomb-and-

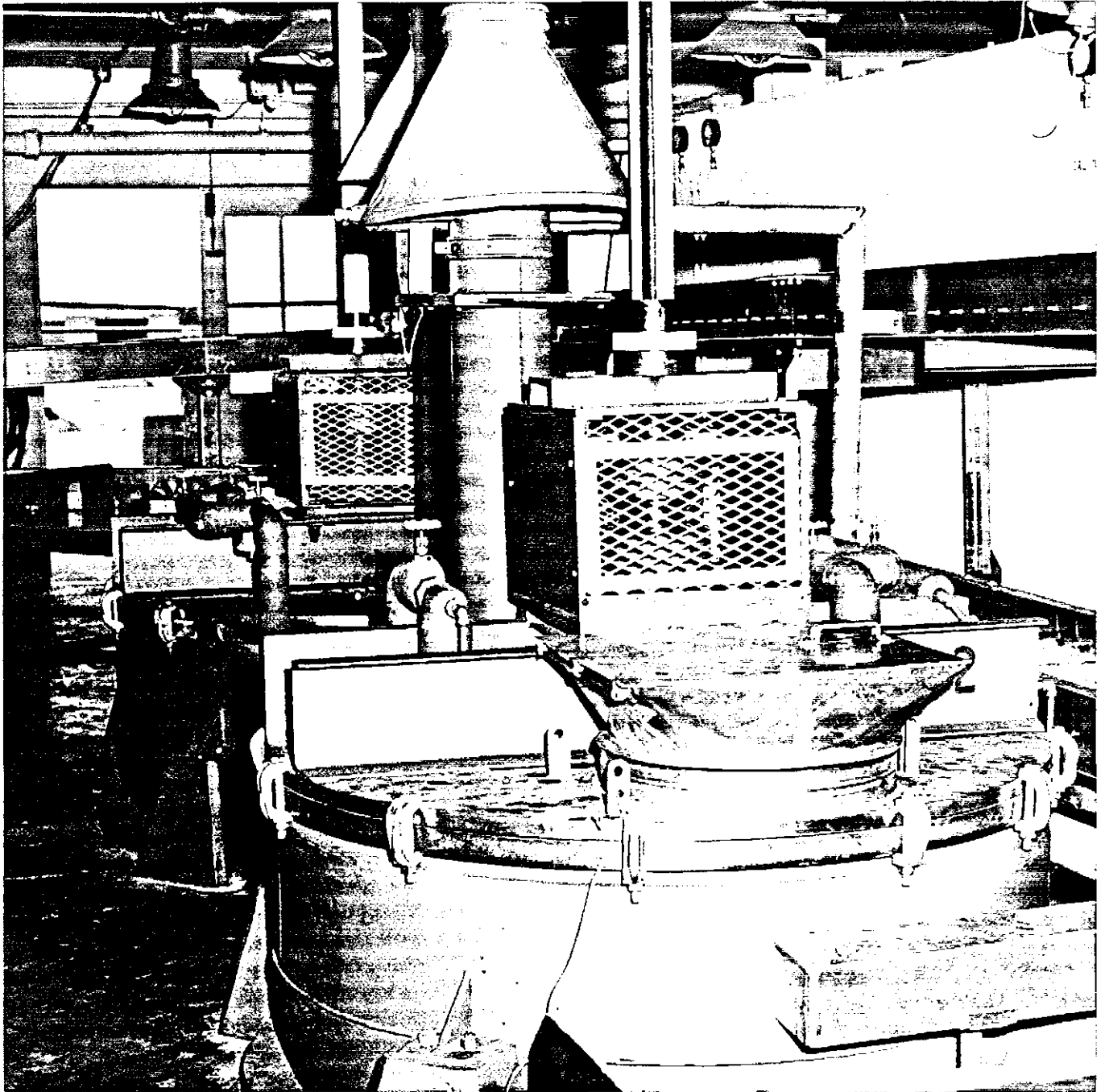


Figure 10: Melt-and-pour equipment, McAlester AAP. (Source: Government Files, McAlester AAP.)

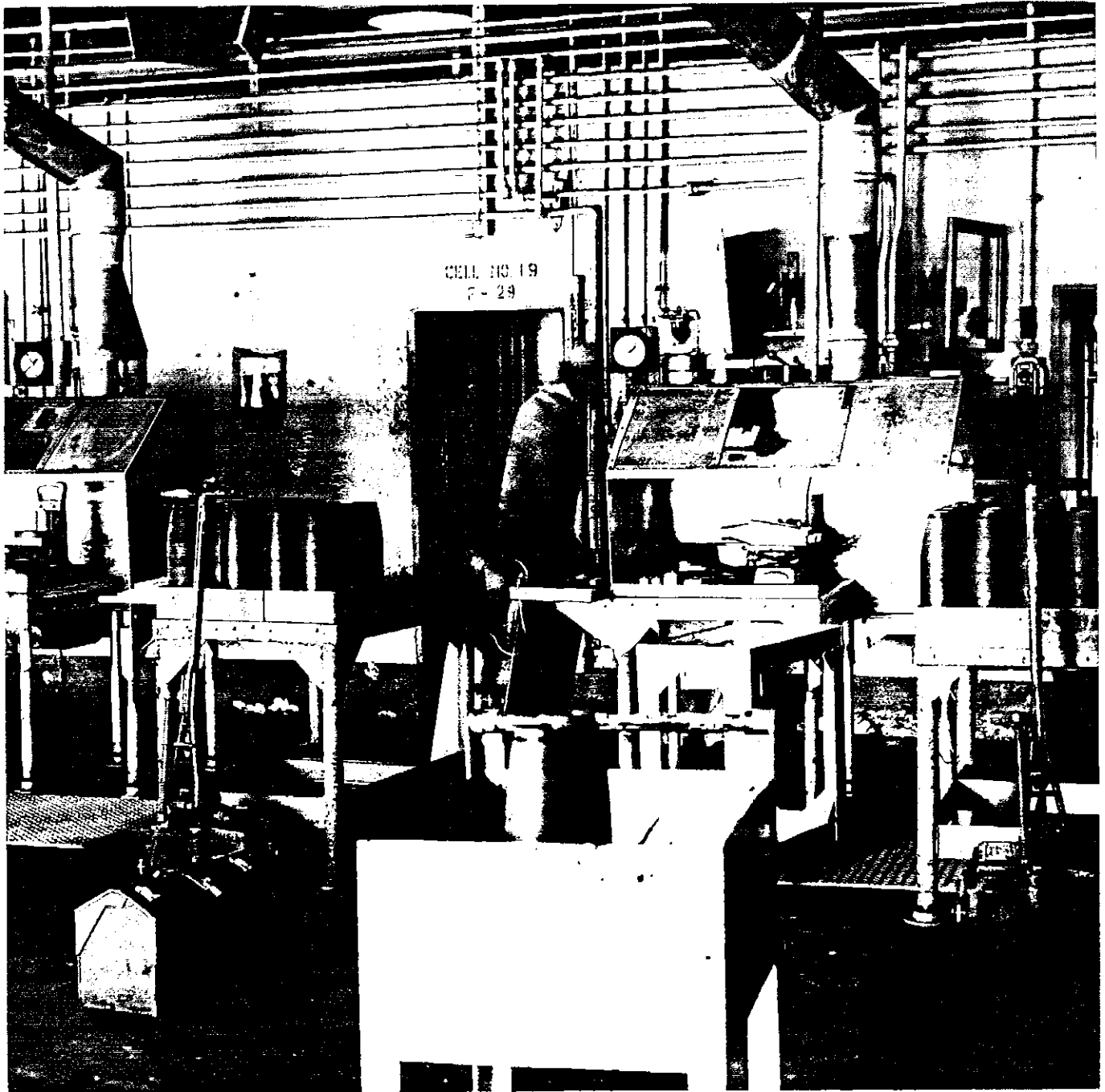


Figure 11: Press loading equipment, McAlester AAP. (Source: Government Files, McAlester AAP.)

mine area was modified to cast "Torpex" (RDX, TNT, and aluminum) rather than "Amatol" (ammonium nitrate and TNT), resulting in the addition of powdered-metal handling facilities and the abandonment of ammonium nitrate facilities before they could be placed in operation.

POST-WORLD WAR II DEVELOPMENT

The close of World War II led to a winding down of activity at McAlester AAP. Construction projects already in progress were completed and manufacturing capabilities were retained, but no new construction was undertaken and manufacturing operations ceased. To ease the unemployment caused by cessation of manufacturing, McAlester AAP was designated a center for salvage and renovation of munitions returned from overseas. McAlester AAP also served briefly as a veterans' training center.¹⁸

KOREAN WAR DEVELOPMENT

The outbreak of the Korean War led to reactivation of the production facilities at McAlester AAP and the expansion of both the magazine and inert storage areas.

New magazine construction followed previously established patterns and included 188 smokeless powder magazines (Groups 47PC-50PC plus 4P and 5P) similar to the rectangular boxes of the 1940s; 83 high explosive magazines (Groups 36AT-38AT) similar to the 80' single barrel vaults; and 27 fuse and

detonator magazines (portions of Groups 61FC, 62FC) similar to the earlier 20' single barrel vaults. No further triple barrel vaults or Corbetta beehives were constructed. Construction was started in 1952 and completed in 1953.¹⁹

Inert storage warehouses (Groups 51SH, 52SH, and 57SH) also were built in 1952-53. They can be differentiated from earlier structures primarily by their use of metal ridge vents rather than wood.²⁰

A number of small buildings were built to provide storage, shop, and administrative facilities in scattered work areas. The only substantial building from this period, other than the magazines and inert storage warehouses, was a large (89,880-square-foot) one-story Storage Building (Building 567).²¹

Korean War production processes were similar to those used in World War II. Some equipment was replaced, and other equipment was retooled to manufacture new sizes of munitions. There is little information, however, about the specific changes that were made. All production areas were active during 1952 and 1953, and production was reduced in 1954. Large-scale loading ceased in 1955, and the base reverted to renovation and salvage operations.²²

VIETNAM WAR DEVELOPMENT

The production lines of McAlester AAP were again activated during the Vietnam War, and some modernization of manufacturing equipment was undertaken. Thirty family housing units were completed in 1969, including twelve single-family buildings for company grade and warrant officers, and nine duplex buildings for noncommissioned officers.²³

POST-VIETNAM DEVELOPMENT

Following the end of U.S. involvement in Vietnam, McAlester AAP again curtailed its production program. Unlike earlier periods, however, production did not cease entirely. The facility currently produces 20-mm cartridges, 5" projectiles, APAM (antipersonnel, antimateriel) bombs, 500-pound bombs, and inert bombs.²⁴

The McAlester facility was transferred from the Navy to the Army in November 1975, when the Army became the "Single Manager for Conventional Ammunition" for the U.S. Department of Defense. McAlester Naval Ammunition Depot was officially "disestablished" on September 19, 1977, and McAlester Army Ammunition Plant was established on October 1, 1977. Operations and ammunition production were not significantly affected by the transfer.²⁵

NOTES

1. Meleo M. Schene, untitled history of McAlester Naval Ammunition Depot, pp. 1-17. Unpublished report c. 1963 in files of Oklahoma Historical Society, Oklahoma City.
2. Capt. E.L. Woodside, "History of Naval Ammunition Depot, McAlester, Oklahoma, to 14 August 1945," p. 2. Unpublished report c. 1945 in files of Administrative Services Office, McAlester AAP.
3. Building the Navy's Bases in World War II, Vol. 1, (Washington, D.C.: U.S. Government Printing Office, 1947), p. 331.
4. Building the Navy's Bases, p. 331.
5. Major George D. Rogers, "Military Explosives," National Safety News, 44 (July 1941), 22. According to the Ordnance Department's Safety Officer, "the guiding principals which were followed in laying out [a] plant are: 1. Hazardous operations have been separated from each other by barricades or by placing them in separate buildings. 2. Operating buildings have been separated from each other by safe distances to prevent the spread of fires or explosions. 3. Operating buildings have been grouped into separate production lines whose sizes and capacities are based on efficient and economical operation 4. Equipment layouts in operating buildings have been made with a view toward eliminating hazards from electrical installations, mechanical or static sparks, and fires from lightning or other causes. 5. Change houses and bomb proof shelters have been provided where necessary for the comfort and safety of operating personnel." Although specifically designed for the Army, these same considerations were applied to Navy installations as well.
6. Engineering construction drawings for both World War II and Korean War construction activities, in files of the Facilities Engineering Office, McAlester AAP.
7. "Command History, U.S. Naval Ammunition Depot, McAlester, Oklahoma, 1 January 1960 - 31 December 1960," unpublished report prepared by Administrative Services Office, McAlester Naval Ammunition Depot, 1961, pp. 2-3 in files of Administrative Services Office, McAlester AAP. Includes transcripts of several documents concerning the establishment of McAlester AAP.
8. Building the Navy's Bases, pp 331-338.
9. "Simplified Design for Munitions Igloos," Engineering News-Record, 131 (November 4, 1943), 94-97. Contains an extended discussion of the techniques of construction for both beehive and barrel vault magazines. Also see Lt.Col. C. H. Cotter, "Naval Ammunition Depot Near Hawthorne, Nev., Built to Serve the Pacific Coast," Engineering News-Record, 105 (November 20, 1930), 803-

805; and Paul Nissen, "Igloos of Concrete," Pacific Builder and Engineer, 47 (September 1941), 40-44.

10. "DARCOM Installation Inventory of Military Real Property," computer printout, December 31, 1981.
11. "Simplified Design," pp. 94-97.
12. Ibid., pp. 92-94.
13. "DARCOM Installation Inventory."
14. "Simplified Design," pp. 92-94.
15. Engineering construction drawings.
16. "DARCOM Installation Inventory."
17. "Hourly Earnings in the Ammunition-Loading Industry, 1944," Monthly Labor Review, 60 (April 1945), 840-841.
18. "Command History, 1960," pp. 69-70.
19. DARCOM Installation Inventory."
20. Ibid. Verified by personal inspection by Robert C. Mack.
21. Ibid.
22. "Command History, 1960," pp. 70-71.
23. "DARCOM Installation Inventory."
24. "Annual Historical Review, McAlester Army Ammunition Plant, 1 October 1980 - 30 September, 1981," pp. 20-21, unpublished report prepared by Administrative Services Office, McAlester AAP, 1981, in files of Administrative Services Office, McAlester AAP.
25. "DARCOM Installation and Activity Brochure," unpublished, June 30, 1980.

Chapter 3

PRESERVATION RECOMMENDATIONS

BACKGROUND

Army Regulation 420-40 requires that an historic preservation plan be developed as an integral part of each installation's planning and long-range maintenance and development scheduling.¹ The purpose of such a program is to:

- Preserve historic properties to reflect the Army's role in history and its continuing concern for the protection of the nation's heritage.
- Implement historic preservation projects as an integral part of the installation's maintenance and construction programs.
- Find adaptive uses for historic properties in order to maintain them as actively used facilities on the installation.
- Eliminate damage or destruction due to improper maintenance, repair, or use that may alter or destroy the significant elements of any property.
- Enhance the most historically significant areas of the installation through appropriate landscaping and conservation.

To meet these overall preservation objectives, the general preservation recommendations set forth below have been developed:

Category I Historic Properties

All Category I historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for

nomination regardless of age. The following general preservation recommendations apply to these properties:

- a) Each Category I historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category I historic properties should not be altered or demolished. All work on such properties shall be performed in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).
- b) An individual preservation plan should be developed and put into effect for each Category I historic property. This plan should delineate the appropriate restoration or preservation program to be carried out for the property. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above-referenced ACHP regulation. Until the historic preservation plan is put into effect, Category I historic properties should be maintained in accordance with the recommended approaches of the Secretary of Interior's Standards for Rehabilitation and

Revised Guidelines for Rehabilitating Historic Buildings² and
in consultation with the State Historic Preservation Officer.

- c) Each Category I historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.³ When no adequate architectural drawings exist for a Category I historic property, it should be documented in accordance with Documentation Level I of these standards. In cases where standard measured drawings are unable to record significant features of a property or technological process, interpretive drawings also should be prepared.

Category II Historic Properties

All Category II historic properties not currently listed on or nominated to the National Register of Historic Places are assumed to be eligible for nomination regardless of age. The following general preservation recommendations apply to these properties:

- a) Each Category II historic property should be treated as if it were on the National Register, whether listed or not. Properties not currently listed should be nominated. Category II historic properties should not be altered or demolished. All work on such properties shall be performed

in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation (ACHP) as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800).

- b) An individual preservation plan should be developed and put into effect for each Category II historic property. This plan should delineate the appropriate preservation or rehabilitation program to be carried out for the property or for those parts of the property which contribute to its historical, architectural, or technological importance. It should include a maintenance and repair schedule and estimated initial and annual costs. The preservation plan should be approved by the State Historic Preservation Officer and the Advisory Council in accordance with the above-referenced ACHP regulations. Until the historic preservation plan is put into effect, Category II historic properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings⁴ and in consultation with the State Historic Preservation Officer.
- c) Each Category II historic property should be documented in accordance with Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Documentation Level

II, and the documentation submitted for inclusion in the HABS/HAER collections in the Library of Congress.⁵

Category III Historic Properties

The following preservation recommendations apply to Category III historic properties:

- a) Category III historic properties listed on or eligible for nomination to the National Register as part of a district or thematic group should be treated in accordance with Sections 106 and 110(f) of the National Historic Preservation Act as amended in 1980, and the regulations of the Advisory Council for Historic Preservation as outlined in the "Protection of Historic and Cultural Properties" (36 CFR 800). Such properties should not be demolished and their facades, or those parts of the property that contribute to the historical landscape, should be protected from major modifications. Preservation plans should be developed for groupings of Category III historic properties within a district or thematic group. The scope of these plans should be limited to those parts of each property that contribute to the district or group's importance. Until such plans are put into effect, these properties should be maintained in accordance with the recommended approaches in the Secretary of the Interior's Standards for Rehabilitation and Revised

Guidelines for Rehabilitating Historic Buildings⁶ and in consultation with the State Historic Preservation Officer.

- b) Category III historic properties not listed on or eligible for nomination to the National Register as part of a district or thematic group should receive routine maintenance. Such properties should not be demolished, and their facades, or those parts of the property that contribute to the historical landscape, should be protected from modification. If the properties are unoccupied, they should, as a minimum, be maintained in stable condition and prevented from deteriorating.

HABS/HAER Documentation Level IV has been completed for all Category III historic properties, and no additional documentation is required as long as they are not endangered. Category III historic properties that are endangered for operational or other reasons should be documented in accordance with HABS/HAER Documentation Level III, and submitted for inclusion in the HABS/HAER collections in the Library of Congress.⁷ Similar structures need only be documented once.

CATEGORY I HISTORIC PROPERTIES

There are no Category I historic properties at the McAlester AAP.

CATEGORY II HISTORIC PROPERTIES

There are no Category II historic properties at the McAlester AAP.

CATEGORY III HISTORIC PROPERTIES

C-Tree School, Building 90

- . Background and significance. The C-Tree School is the oldest structure on the McAlester AAP site. It was constructed in 1934 under the WPA and served the farming community that occupied the site prior to its purchase by the Navy in 1942. Originally a two-room school, this simple native-stone structure is now the office of the Building and Grounds Division of the Facilities Engineering Directorate. Although the interior has been altered, the exterior of the building remains intact and serves as a significant reminder of the history of the site.
- . Condition and potential adverse impacts. The C-Tree School is in good condition and receives routine maintenance and repair. There are no current plans to alter or demolish this structure.
- . Preservation options. See the general recommendations at the beginning of this chapter for Category III properties.

Explosives Storage Facilities, Building Groups 41LC, 46LC, and 42DC-45DC

- Background and significance. Two types of explosives storage facilities, "Corbetta beehives" (Groups 42DC-45DC) and "triple barrel vaults," (Groups 41LC, 46LC), are significant because of structural and functional innovations that resulted in economies of materials and ease of operation and access. Both types of structures were grouped in threes to allow construction of common walls and foundations, as well as rail access from a single loading dock.

The "Corbetta beehive" was developed to reduce material requirements and to simplify the construction process. Although comparable to the more common barrel vault in storage capacity, the domed shape of the "beehive" required only half the steel reinforcement. McAlester AAP was the only Navy installation to utilize this unique structural innovation. The "triple barrel vault" as constructed at McAlester AAP demonstrated a number of further structural innovations, including a common foundation slab in place of extensive footings, and the substitution of steel mesh for individual reinforcing rods, both of which resulted in significant reductions in the quantities of steel and concrete required..

- Condition and potential adverse impacts. All of the explosives storage facilities are in good condition and receive routine maintenance and repair. The facilities have not been altered significantly. There are no current plans to alter or demolish any of these structures.

- . Preservation options. A representative example of each of these explosives storage facilities should be identified and preserved. See the general preservation recommendations at the beginning of this chapter for Category III properties.

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1. Army Regulation 420-40, Historic Preservation (Headquarters, U.S. Army: Washington, D.C., 15 April 1984).
2. National Park Service, Secretary of Interior's Standards for Rehabilitation and Revised Guidelines for Rehabilitating Historic Buildings, 1983 (Washington, D.C.: Preservation Assistance Division, National Park Service, 1983).
3. National Park Service, "Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines," Federal Register, Part IV, 28 September 1983, pp. 44730-44734.
4. National Park Service, Secretary of the Interior's Standards.
5. National Park Service, "Archeology and Historic Preservation."
6. National Park Service, Secretary of the Interior's Standards.
7. National Park Service, "Archeology and Historic Preservation."

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DEPARTMENT OF THE ARMY
McALESTER ARMY AMMUNITION PLANT
McALESTER, OKLAHOMA 74501

REPLY TO
ATTENTION OF

SARMC-AS

24 February 1983

SUBJECT: DARCOM Historic Survey

TO: Mr. Stuart MacDonald
Mr. Robert Mack

1. For security reasons, the following areas will not be available for your historical survey:

- a. 50 PC
- b. 7 AT
- c. 8 AT

2. The exclusion of these areas should not affect your survey since the same types of structures are located in other areas to which you have access.

3. Your understanding of our position in this matter is appreciated.

FOR THE COMMANDER:

A handwritten signature in dark ink, appearing to read "Theodore L. Roberts II", is written over the typed name.

THEODORE L. ROBERTS II

Major(P), TC

Director for Administrative Services